Patent Claims

1. A layer system (1),
at least comprising a substrate (4) and
an at least partially porous layer (10) on the substrate (4),
a pore (25) in the porous layer (10) in each case being delimited by pore walls (22),
which (22) in some cases adjoin a surface (9, 14) of the substrate (4),

characterized in that

the pore walls (22)
which adjoin the surface (9, 14)
have a larger cross-sectional area in the region of the surface (9, 14) of the substrate (4) than the pore walls (22)
which do not adjoin the region of the surface (9, 14),
resulting in improved mechanical bonding of the pore walls (22) to the substrate (4).

2. The layer system as claimed in claim 1,
characterized

in that the surface (9) of the substrate (4) of the layer system (1) adjoins a region (110, 111)
which is exposed to a hot medium, and
in that the porous layer (10) is formed on the opposite surface (14) of the substrate (4) from the surface (9).

3. The layer system as claimed in claim 1 or 2,
characterized

in that the surface (9) of the substrate (4) of the layer system (1) can be exposed to a hot medium

which is present in a region (110, 111), and
in that the porous layer (10) is formed on the surface (9) of the substrate (4).

4. The layer system as claimed in claim 1, 2 or 3, characterized

in that the contact zones between layer (10) and substrate (4) at the surface (9, 14) are in each case formed by a wall section surface (19), and
in that the size of the wall section surface (19) at the surface (9, 14) is larger than the wall section surfaces (19) which do not adjoin the region of the surface (9, 14),
resulting in improved mechanical bonding of the wall section surface (19) to the substrate (4).

5. The layer system as claimed in claim 1 or 4, characterized in that

a contact surface between the pore walls (22) and/or the wall section surfaces (19) and the substrate (4) forms at least 10% of the surface (9, 14) of the substrate (4) which is covered by the porous layer (10).

6. The layer system as claimed in claim 1 or 5, characterized in that

the thickness of the pore walls (22) varies,
in particular in a radial direction (11),
running perpendicular to the surface of the substrate (4).

7. The layer system as claimed in claim 6, characterized in that

the thickness of the pore walls (22) has a gradient along the radial direction (11).

8. The layer system as claimed in claim 6 or 7, characterized in that

the thickness of the pore walls (22) is greater in the vicinity of the substrate (4).

9. The layer system as claimed in claim 6 or 7, characterized in that

the thickness of the pore walls (22) is designed to increase starting from the substrate (4) toward the outer surface (16) of the porous layer (10).

10. The layer system as claimed in claim 1, 6, 7, 8 or 9, characterized

in that a radial direction (11) extends from the substrate (4) toward the outer surface (16) of the layer system (1), and
in that the pore sizes (28) of the pores (25) have a gradient along the radial direction (11).

11. The layer system as claimed in claim 10, characterized in that

the pore size (28) is smaller in the vicinity of the substrate (4) than in the vicinity of the outer surface (16) of the porous layer (10).

12. The layer system as claimed in claim 1, characterized in that

edges of pore walls (22) or of passages (26) in the pore walls (22) are at least partially rounded.

13. The layer system as claimed in claim 1, characterized in that

the porous layer (10) has a honeycomb structure.

14. The layer system as claimed in claim 1, characterized in that

the porous layer (10) has a structure through which a cooling medium can at least partially flow.

15. The layer system as claimed in claim 1, characterized in that

the porous layer (10) has at least one protective layer (12) at least in the region of the outer surface (16) of the layer (10).

16. The layer system as claimed in claim 1 or 15, characterized in that

at least one protective layer (12) is applied within the porous layer (10) at least in the region of the outer surface (16).

17. The layer system as claimed in claim 1 or 15, characterized in that

at least one protective layer (12) is applied to the surface (16) of the porous layer (10).

18. The layer system as claimed in claim 15, 16 or 17, characterized in that

the at least one protective layer (12) is metallic or ceramic.

19. The layer system as claimed in claim 15, 16, 17 or 18, characterized

in that the porous layer (10) is metallic, and
in that the protective layer (12) is ceramic.

20. The layer system as claimed in claim 1, characterized in that

the layer system (1) is a gas or steam turbine component, in particular a turbine blade or vane (120, 130) or a combustion chamber lining (155).

21. The layer system as claimed in claim 1 or 20, characterized in that

the substrate (4) is metallic,
in particular an iron-base, nickel-base or cobalt-base superalloy.

22. The layer system as claimed in claim 1 or 18, characterized in that

the porous layer (10) is ceramic in form.

23. The layer system as claimed in claim 1, characterized in that

the porous layer (10) is metallic, in particular has the composition of an MCrAlX composition,
where M stands for at least one element selected from the group consisting of iron, cobalt or nickel,

and X is yttrium and/or at least one rare earth element.

24. The layer system as claimed in claim 1, 22 or 23, characterized in that

the porous layer (10) is formed integrally with the substrate (4).

25. The layer system as claimed in claim 1, characterized in that

the layer system (1) has cooling passages (13, 26) in the substrate (4) and/or in the pore walls (22).

26. The layer system as claimed in claim 1, characterized in that

the size (28) of the pores (25) in the layer (10) is larger than the size of foreign particles in a medium which flows through the layer (10).

27. A process for producing a layer system (1) having a porous layer (10), in particular as claimed in claim 1, characterized in that

the porous layer (10) is produced in layers in a plurality of substeps.

28. The process as claimed in claim 27, characterized in that

the outer surface of the porous layer (10) is joined to the substrate (4), in particular by soldering.

29. The process as claimed in claim 27, characterized in that

stereolithography, in particular laser stereolithography, is used
to produce the porous layer (10).

30. The process as claimed in claim 27 or 29, characterized in that

plastic or the like is applied to the substrate (4) in layers (10', 10", 10''') as a negative form
and is cured by means of a laser (20),
resulting in the pores (25) of the porous layer (10),
which are then surrounded, in particular by casting, with the material of the layer (10),
so as to produce the porous layer (10).

31. The process as claimed in claim 27 or 29, characterized in that

a model of the porous layer (10) is produced, in particular from plastic,
and a casting mold for the porous layer (10) is produced from this model by duplicate molding, and
in that the porous layer (10) is produced using this casting mold.

32. The process as claimed in claim 27, characterized in that

printing paste,
which contains material of the layer (10)
is applied to the substrate (4) in layers,
in such a way as to produce the porous layer (10) and the pores (25).

33. A process for producing the layer system as claimed in claim 1,
characterized in that

the porous layer (10) is produced together with the substrate (4).

34. The process as claimed in claim 33,
characterized in that

the substrate (4) is produced together with the porous layer (10) by melt metallurgy, in particular by casting.